

Spatial and Temporal Patterns of Paralytic Shellfish Poisoning Toxin in Puget Sound

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Abstract

The Washington State Department of Health (DOH) monitors bio-toxins in shellfish from Washington state waters to protect shellfish consumers from harm. Each year DOH analyzes spatial and temporal trends in Paralytic Shellfish Poisoning (PSP) toxin for the Puget Sound Ambient Monitoring Program (PSAMP). Status and trends have been analyzed for 10 years of data. For the year ending 2001, PSP levels measured in mussels from 34 Sentinel Monitoring Sites in Puget Sound and the straits of Georgia and Juan de Fuca were sorted into four impact categories (none-high). Twenty-four sites had at least minimal impact. A PSP Impact Factor (based on duration of PSP incident) was used to rank impact. Sites in Hood Canal, Totten Inlet (south Puget Sound), and Westcott Bay (San Juan Islands) were free of PSP in 2001.

Background

The Washington State Department of Health (DOH) protects shellfish consumers by monitoring changes in levels of bio-toxins in shellfish tissue. The State has monitored bio-toxin levels in shellfish since the 1930s. Monitoring was greatly expanded by the 1960s. Now samples are analyzed from hundreds of sites throughout Puget Sound and coastal waters. In 1990, DOH set up a Sentinel Mussel Monitoring Program to provide early warning of blooms of toxic algae leading to harmful levels of “paralytic shellfish poisoning” (PSP) and other bio-toxins.

Objectives

Public Health (primary objective). When harmful levels of bio-toxins are detected, DOH immediately warns commercial shellfish growers, local health agencies, tribal agencies, and the public. Warnings are continually updated via print and electronic media, the DOH Bio-toxin Hotline (1.800.562.5632), or Internet (www.doh.wa.gov/ehp/sf/biotoxin.htm).

PSAMP. Each year, DOH analyzes spatial and temporal trends in PSP and reports results to the Puget Sound Ambient Monitoring Program (PSAMP). A major goal is to determine if human activities can explain changing patterns in environmental factors, including bio-toxins.

Methods

Under the Sentinel Program, several mussel species (*Mytilus edulis*, *M. galloprovincialis*, and *M. californianus*) are gathered every two weeks at more than 40 Puget Sound sites from wire mesh cages suspended below floats and docks, or collected wild from floats, pilings and rocks (Nishitani 1990). Seventy to 100 average-sized mussels (1-2 inches in length) are sent to the DOH Public Health Laboratory for analysis according to APHA (1984).

PSAMP Analysis

Figure 1 summarizes PSP results from sampling sites. PSP results from each site were sorted into categories according to impact. (Definitions of categories are above in the box labeled **PSP IMPACT CATEGORIES**.) Pie charts on Figure 1 show fractions of categorized results at each site during the year.

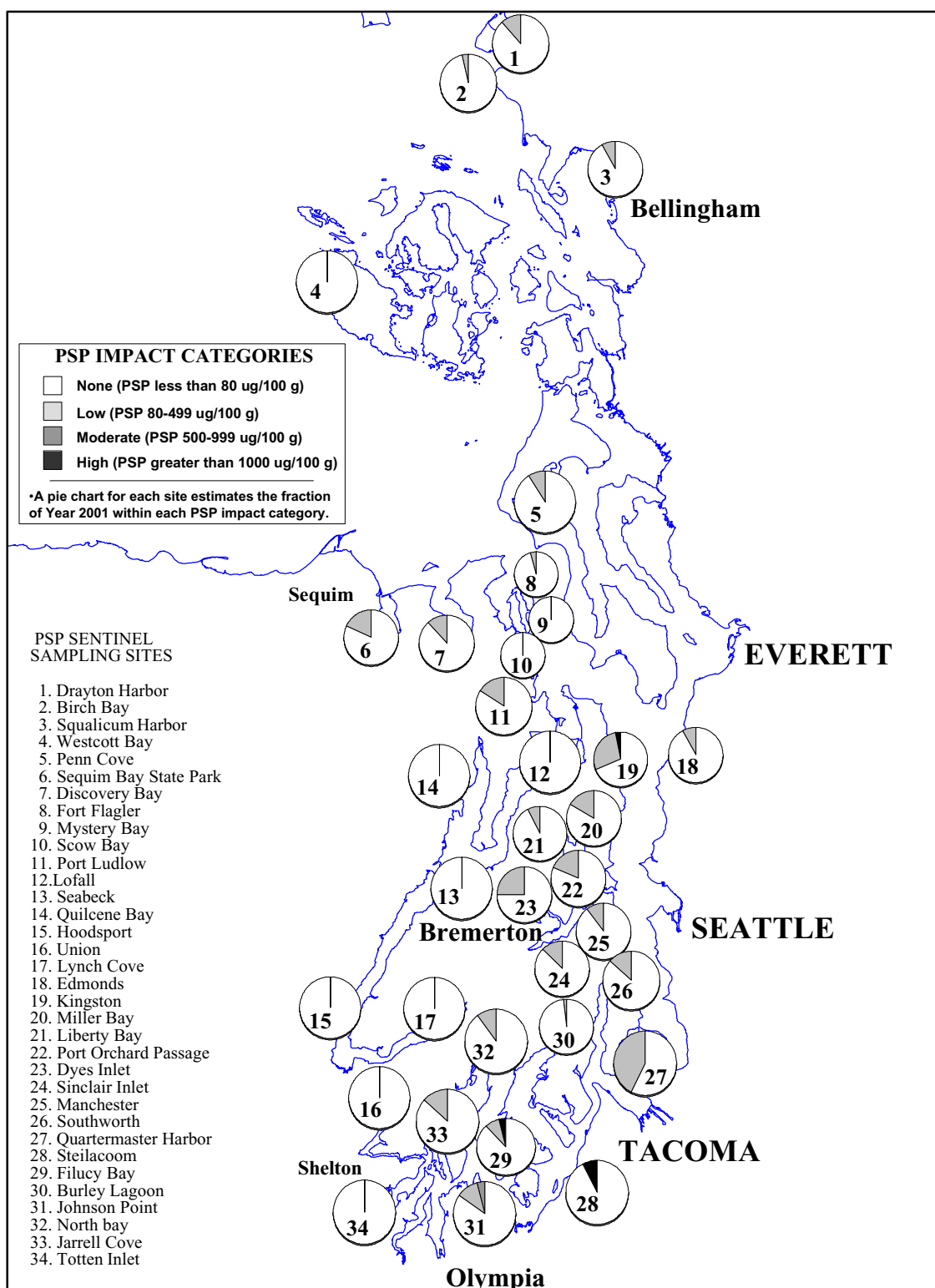


Figure 1. Spatial distribution of PSP in 2001.

Figure 2 shows the ranking of PSP sampling sites according to PSP impact. For each impacted site (i.e., sites with fractions of results greater than “none”), each impact category was multiplied by a “weighting factor” (low=1; moderate=2; high=3). The weighted values were then combined to produce an **Impact Factor** for each site.

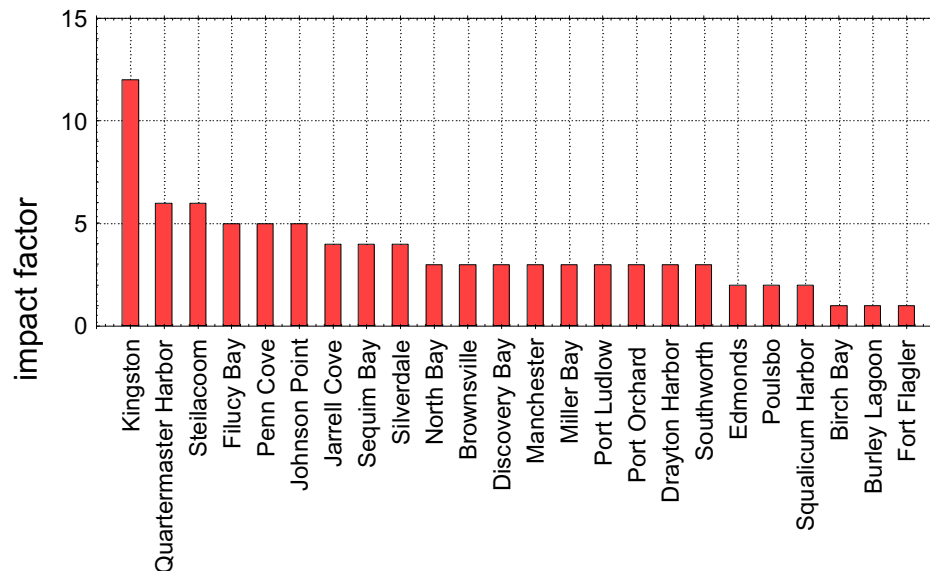


Figure 2. Ranking of PSP-impacted sites.

Figure 3 shows Annual PSP Duration at selected sampling sites. **Annual PSP Duration** is the number of days in a year when PSP toxin levels in shellfish exceed the FDA safety level of 80 µg/100 g shellfish tissue. Annual duration was estimated at each Sentinel Monitoring site for the years 1991-2001.

Observations

- There is little evidence of a positive link between human activity and PSP intensity in Puget Sound.
- Some sites with a high impact factor (Figure 2) were in relatively isolated areas (e.g., Filucy Bay and Sequim Bay). Some sites with a low impact factor were in urbanized areas (e.g., Port Orchard near Bremerton and Squalicum Marina in Bellingham).
- Kingston (main Puget Sound Basin) had the highest PSP impact in 2001 (Figure 2).
- Hood Canal and Totten Inlet had no PSP in 2001.
- Sites with records of intense PSP activity tend to be highly variable from year to year (see Figure 3).

Conclusions

- The time and place of PSP episodes currently cannot be predicted due to interaction of many poorly understood environmental factors.
- Protection of shellfish consumers from poisoning from bio-toxins will require continued routine monitoring throughout Puget Sound and coastal waters.

References

- American Public Health Association. 1984. *Laboratory procedures for the examination of seawater and shellfish*. APHA, Washington D.C.
- Nishitani, L. 1990. Suggestions for the Washington PSP monitoring program and PSP research. Prepared for DOH Office of Shellfish Programs, Olympia. WA. 12pp.

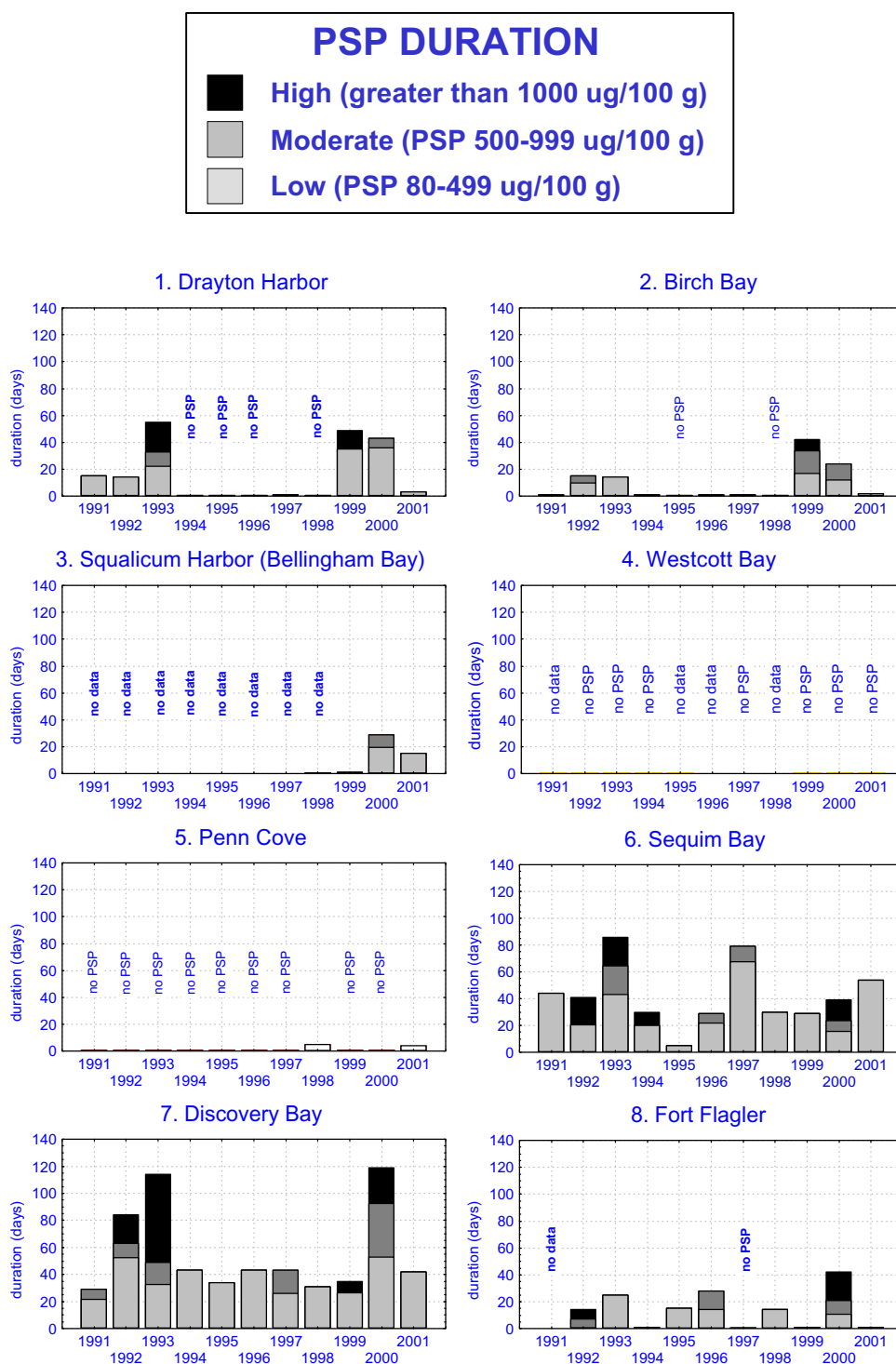


Figure 3. Annual PSP duration at selected sites 1991-2001.